

The ‘WMO Stewardship Maturity Matrix for Climate Data’ Template

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Steps for carrying out a self-evaluation of data stewardship maturity of a dataset:

- i) Download the latest **WMO** Stewardship Maturity Matrix for Climate Data (**SMM-CD**) template file from doi:10.6084/m9.figshare.7003709;
- ii) Go over the whole file and read the disclaimer carefully before using the template;
- iii) Enter dataset and relevant Point-Of-Contacts (POCs) information in the **WMO SMM-CD** metadata section;
- iv) Read the content of **WMO SMM-CD**; for additional background information, download and read the guide for the SMM-CD from doi: 10.6084/m9.figshare.7002482;
- v) Go through each Category with its relevant Aspects, identify the stewardship practices applied to the dataset, and document your rating and justifications;
- vi) Obtain any additional information if necessary and, if any, restrictions should be stated;
- vii) Review the results and fill in the matrix cells with the defined color scheme (provided in Table I);
- viii) Capture the assessment results in the **WMO SMM-CD** metadata section and in the header ‘**Stewardship Maturity Ratings**’ for each Aspect, along with the evidences.

Assumptions:

- Datasets are digital environmental data products that are publicly available online.
- Evaluators who use this template have a basic knowledge of or are able to obtain information about conventions or standards relevant to practices examined in each key component in the community that datasets are produced for or/and provided to.

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Disclaimer: This template is provided “as is” without any representations or warranties, express or implied. WMO makes no representations or warranties in relation to this template or the information and materials provided on this template. Use for the template is intended for use as a preliminary stewardship maturity assessment of a dataset, utilizing the latest **WMO SMM-CD**. Examples in the SMM-CD manual for each category with its individual aspects are provided only to help users of the SMM-CD to better understand the meaning of the languages used in the matrix. No endorsement or preference is intended.

WMO will not be liable to you or a third party (data provider, data user, contractors, etc.) in relation to the contents of, or use of, or otherwise in connection with, this temple for any direct loss, for any indirect, special or consequential implications on business, reputation or goodwill or misinterpretation and misuse of the dataset for which maturity assessment was made using this template.

The layout or/and content of the matrix and template are subject to change any time without notification.

Subject Matter Experts (SME) who carried out their self-evaluations of the **WMO SMM-CD** of their datasets are encouraged to document justifications in detail (with URL links if applicable) and make them available to data users at the dataset web sites to allow transparency and feedback from the data users.

Any opinions or recommendations expressed here are those of the people who have carried out the assessment and do not necessarily reflect the views of WMO, CICS-NC, or NCEI.

WMO Stewardship Maturity Matrix for Climate Data (SMM-CD) Assessment as of <04/28/2021> for <HadCRUT.5.0.1.0>

Dataset Title	Met Office HadCRUT.5.0.1.0
Dataset Information URL	https://www.metoffice.gov.uk/hadobs/hadcrut5/
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Dataset POC (Name; E-mail; Affiliation)	Colin Morice, colin.morice@metoffice.gov.uk , Met Office Hadley Centre
WMO SMM-CD Version (Document ID and Version Number)	WMO-SMM-CD-0001-v05r00-20200529
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WMO SMM-CD Template Version (Document ID and Version Numbers)	WMO-SMM-CD-0003-v04r01-20200615
WMO SMM-CD Template POC (Name; E-mail; Affiliation)	Christina Lief; Christina.lief@gmail.com ; Ret.NOAA
Assessment Version (v<nn>r<mm>, e.g., v01r00)	V01r00
Assessment Date (MM/DD/YYYY)	4/28/2021
Assessment POC (Name; E-mail; Affiliation)	Ali Eddenjal; ali.eddenjal@fulbrightmail.org ; SERCOM ET-DRC
Stewardship Maturity Ratings (each category and associated aspects)	4, 4; 4, 3/4, 5; 5, 5, 1; 3, 2, 3
Original Assessment Date (MM/DD/YYYY)	
Original Assessment POC (Name; E-mail; Affiliation)	

Categories and Aspects	Level 1 Ad Hoc Not Managed	Level 2 Minimal Limit-Managed Not Defined	Level 3 Intermediate Managed Defined, Partially Implemented	Level 4 Advanced Well-Managed Well-Defined, Fully Implemented	Level 5 Optimal Level 4 + Measure, Controlled, Audited	The Data Access category refers to the ability to locate (Discoverability) and get to the dataset in question (Accessibility), with higher levels of maturity corresponding to the ease for a potential user to find and gain access to the dataset	
Data Access						WMO SMM-CD Rating and Justification or Evidence	Comments
<i>Discoverability</i>	By personal contact only; Dataset information not discoverable.	Limited dataset information, such as scientific description of the methodology, available online.	Level 2 + minimal catalogue-level metadata; Dataset searchable online.	Level 3 + comprehensive set of collection-level discovery metadata + minimal granule metadata.	Level 4 + available on an international catalogue, prominently displayed online and routinely updated.	❖ Level 4 + Paper describing dataset (Morice et al, 2021) + netCDF files have metadata + Available at international catalogues <ul style="list-style-type: none"> https://catalogue.ceda.ac.uk/uuid/b9698c5ecf754b1d981728c37d3a9f02 https://climatedataguide.ucar.edu/climate-data/global-land-ocean-surface-temperature-data-hadcrut5 https://www.metoffice.gov.uk/hadobs/crutem5/ https://crudata.uea.ac.uk/cru/data/temperature/ 	Not level 5 as the data set is now static. Entire dataset is publicly available through the website
<i>Accessibility</i>	Data not available publicly; Person-to-person contact needed.	Basic online services available for data access (e.g. FTP/HTTP direct download).	Available via non-standard data services.	Standard-based interoperability data services.	Level 4 + Full capability of sub-setting, aggregation and visualization.	❖ Level 4 + Data are available at: https://www.metoffice.gov.uk/hadobs/hadcrut5/data/HadCRUT.5.0.0.0/download.html <ul style="list-style-type: none"> + data are available in NetCDF format and ASCII + Also accessible at: https://www.metoffice.gov.uk/hadobs/hadcrut5/data/current/download.html https://catalogue.ceda.ac.uk/uuid/b9698c5ecf754b1d981728c37d3a9f02 https://climatedataguide.ucar.edu/climate-data/global-land-ocean-surface-temperature-data-hadcrut5 https://crudata.uea.ac.uk/cru/data/temperature/#seealso https://www.metoffice.gov.uk/hadobs/crutem5/ https://crudata.uea.ac.uk/cru/data/temperature/ https://catalogue.ceda.ac.uk/uuid/901f576daca4e049630ab879d6fb476	
Usability & Usage	Level 1 Ad Hoc Not Managed	Level 2 Minimal Limit-Managed Not Defined	Level 3 Intermediate Managed Defined, Partially Implemented	Level 4 Advanced Well-Managed Well-Defined, Fully Implemented	Level 5 Optimal Level 4 + Measure, Controlled, Audited	The Usability & Usage category describes how easily the data products may be understood and used by users and incorporated into the user's own working environment	
						WMO SSM-CD Rating and Justification or Evidence	Comments

Data Portability	Non-machine readable.	Basic machine readable.	Standards-based machine readable.	Machine independent, self-describing, interoperable format.	Level 4 + capability of providing selected community formats.	❖ Level 4 • data are provided in NetCDF format	
Documentation	Product information not publicly available online.	Limited online documentation (e.g., User Guide).	Document on how the data product was created and how to use it, is available online.	Comprehensive documentation based on a standard template and available online.	Level 4 + online tutorial on using and analyzing the dataset; Complete production system information available online.	❖ Level 3/(4) + NetCDF files are self-describing ○ https://www.metoffice.gov.uk/hadobs/hadcrut4/data/current/ensemble_series_format.html + Method of creation described by Morice et al, (2021)	
Usage and Impact	No or weak citations in scientific publication in peer-review journal or as institutional reports.	Intermediate citations + referenced in local organizational climate assessment reports (e.g., by NOAA)	Strong citations + referenced in national climate assessment reports (e.g., by USGCRP).	Level 3 + referenced in international climate assessment reports (e.g., by IPCC).	Level 4 + referenced in international decision/policy making published reports (e.g., by UNFCCC, UN-ISDR, World Bank, etc.).	❖ Level 5 ◆ HadCRUT5 used in https://unfccc.int/news/2020-was-one-of-three-warmest-years-on-record ◆ Is also being used on WMO climate reports (State of the Global climate 2020) https://library.wmo.int/index.php?lvl=notice_display&id=21880#.YIViGzyxXIV	
Quality Management	Level 1 Ad Hoc Not Managed	Level 2 Minimal Limit-Managed Not Defined	Level 3 Intermediate Managed Defined, Partially Implemented	Level 4 Advanced Well-Managed Well-Defined, Fully Implemented	Level 5 Optimal Level 4 + Measure, Controlled, Audited	The Quality Management category encompasses quality assurance procedures including quality monitoring, quality control, and quality assessment and communication of reliability	
						WMO SSM-CD Rating and Justification or Evidence	Comments
Quality Assurance & Control Procedure	Ad hoc or no data quality assurance (QA) & control (QC) procedure or information unknown.	QA/QC procedures are defined, documented, and partially implemented.	QA/QC procedures are well-defined according to community best practices, documented and fully applied.	Level 3 + provision of error statistics published or tracked with results made available online and communicated to data providers; Procedures for user feedback, improvement prioritization in place.	Level.4 + detailed analysis of errors and gaps at space-time unit level: (Station, grid-points, daily, monthly and or annual timescale, etc.); QA/QC procedure monitored; Retrospective QC.	❖ Level 5 ★ Uncertainties available in ensemble form as part of dataset download. Full analysis detailed in Morice et al., (2021). Quality control of input data occurs as part of the processing for the two parent datasets: ★ Further information available for marine component (HadSST4: Kennedy et al., 2019). ★ Further information available for land component (CRUTEM5): Osborn,et al., 2021. Same QC stages followed in CRUTEM4.	
Quality Assessment	Product quality assessment not done or done but the assessment results are not documented or not available online.	Product quality assessed; Assessment documented and published online.	Level 2 + uncertainty analysis included in the assessment and published.	Level 3 + product produced by authoritative entity.	Level 4 + product quality assessment method and results published in peer-reviewed journal.	❖ Level 5 Independent data set validation and evaluation has been done & published in peer-reviewed journal (Osborn1 et al., 2021; Morice et al., 2021) https://www.metoffice.gov.uk/hadobs/hadcrut5/HadCRUT5_accepted.pdf https://agupubs.onlinelibrary.wiley.com/doi/10.1029/2019JD032352	

<i>Data Integrity</i>	Unknown or no data integrity check.	Random data integrity check.	Data integrity verified systematically but methodology not commonly known.	Data integrity systematically verified with audit trails, and/or traceability, and following well known practices but not necessarily consistent across platforms.	All steps in data integrity check systematically verified and adhering to well-known practices.	❖ Level 1 No checksum or other information given on website	
Data Management	Level 1 Ad Hoc Not Managed	Level 2 Minimal Limit-Managed Not Defined	Level 3 Intermediate Managed Defined, Partially Implemented	Level 4 Advanced Well-Managed Well-Defined, Fully Implemented	Level 5 Optimal Level 4 + Measure, Controlled, Audited	The Data Management category refers to the processes undertaken to ensure the data and the contextual metadata are securely archived. It covers not just the preservation of the data and metadata with appropriate safeguards, but well defined and informed governance processes to endure that the right procedures are followed at the right times by the right people.	
						WMO SSM-CD Rating and Justification or Evidence	Comments
<i>Preservation</i>	Any storage location; Data only; Lack of systematic data backup.	Non-designated repository; Data backed up systematically.	Designated archive; Basic retention policy publicly defined.	Level 3 + conforming to community archiving standards. Comprehensive retention policy defined and implemented.	Level 4 + archiving process performance controlled, measured, and audited; Future archiving standard changes planned.	❖ Level 3 + Dataset also available at CRU: https://crudata.uea.ac.uk/cru/data/temperature/ + Offsite second server via CEDA – 5.0.0.0 https://catalogue.ceda.ac.uk/uuid/b9698c5ecf754b1d981728c37d3a9f02	
<i>Metadata</i>	Collection-level metadata not publicly available and/or not usable.	Limited collection-level metadata publicly available; Conforming to community-standard; Basic characteristics of dataset.	Level 2 + conforming to international standards in most aspects; limited quality and provenance metadata.	Fully compliant with international standards; Rich metadata content; Basic granule-level metadata; Support dataset provenance.	Level 4 + comprehensive granule-level metadata; Metadata quality controlled and Regularly updated	❖ Level 2 CF-1.0 compliant NetCDF files	
<i>Governance</i>	Responsibility is not defined; No person is assigned.	Responsible entity is identified; Accountability and competency are not well-defined.	Responsibility/accountability and compliance mechanisms are defined; adhere well to data management competency standards; Processes established conforming to community standards.	Level 3 + competency defined; Conforming to international standards; Auditable.	Level 4 + accountability and responsibility well-defined and fully compliant with international standards; transparent; Monitored and audited.	❖ Level 3 ○ Responsible entity (Met Office Hadley Centre) and person (Colin Morice) well defined and noted on website Produced by NMS, Hadley Centre has strong background and competence in dataset production	

Recommended citation for the WMO SMM-CD template:

Lief, C. and G. Peng, 2019: The WMO Stewardship Maturity Matrix for Climate Data (SMM-CD) Template. Document ID: WMO-SMM-CD-0003. Updated 2020. Version: v04r01 20200615. Figshare. doi:10.6084/m9.figshare.7003709.

References:

The SMM-CD Working Group, 2019: The Guidance Booklet on the WMO-Wide Stewardship Maturity Matrix for Climate Data. Document ID: WMO-SMM-CD-0002. Updated 2020. Version: v04r01 20200529. Figshare. doi:10.6084/m9.figshare.7002482.

The SMM-CD Working Group, 2019: A WMO-Wide Stewardship Maturity Matrix for Climate Data. Document ID: WMO-SMM-CD-0001. Updated 2020. Version: v04r00 20200529. Figshare. doi: 10.6084/m9.figshare.7006028.

Peng, G., 2015: The Scientific Data Stewardship Maturity Assessment Model Template, Version: NCDC-CICS-SMM-0001-Rev.1 v4.0 6/23/2015. doi:10.6084/m9.figshare.1211954.

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Table I: RGB Color Scheme for the WMO-Wide Stewardship Maturity Matrix for Climate Data					
Maturity Scale	Color Code	R	G	B	Color
Level 1	Lighter Green	229	244	224	
Level 2	Light Green	203	234	192	
Level 3	Green	176	223	161	
Level 4	Dark Green	85	168	57	
Level 5	Darker Green	56	112	38	